by a particular magma depends chiefly on the pressure to which it is subject. (The influence of temperature is not important in the present connection.) As pressure is gradually relieved during eruption, more and more of the contained gas is discharged. When explosion of vesicles is once initiated at the top of the column it reduces the pressure on lower parts by carrying away some of the lava, and this loss of pressure in turn promotes the exclusion of the gas. If this view of the process is correct, the paroxysmal character of explosive volcanic eruption is strictly analogous to that of geyser eruption.

These theoretic considerations lead to the prediction that when the Pelée spine shall have become so cool as to permit of close inspection, its lava will be found to be porous. Porosity may, perhaps, not be accounted a verification of the theory, but the absence of vesicles would prove it untenable.

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Washington,
May 26, 1904.

A SUGGESTIVE RELATION BETWEEN THE GRAVITATIONAL CONSTANT AND THE CONSTANTS OF THE ETHER.

The phenomena of radio-activity and the ionization of gases point so strongly toward the electrical constitution of matter, that the writer has made an attempt to connect the fundamental constant of gravitation with the electrical constants of the ether.

The result obtained is published with the hope that it may suggest to other physicists a more valuable extension.

The gravitational equation as ordinarily written is

$$F = k\frac{M,\ M^1}{r^2},$$

where k is the gravitational constant and M, M^1 are the gravitating masses. The unit of mass is the gram. This is a purely arbitrary unit, so I have chosen a new unit of mass, which may be defined as follows: The unit of mass shall be that mass which is associated with one electromagnetic unit each of positive and negative electricity. This mass is considered to be made up of electrons, each of which has a definite mass associated with a definite amount of electricity.

The adoption of this unit of mass involves a change in the numerical value of the gravitational constant. The object of this paper is to investigate the value of this constant.

The ratio of the charge to the mass of an electron as well as the charge itself has been determined by direct experiment. The most probable value of the charge e on an electron is 10^{-20} electromagnetic units, as measured by Mr. H. A. Wilson. The ratio e/m has been measured by a number of physicists. The following are some of the best values found by experiment:

Kaufmann (1898)	1.86×10^7
Simon (1899)	1.865×10^7
Lenard (1899)	1.15×10^7
Kaufmann (1901)	1.31×10^7
Wiechert (1899)	1.42×10^7

The mean of the above values is $e/m = 1.52 \times 10^7$ electromagnetic units. This quantity as well as the charge e is probably correct to one significant figure.

The charge e as stated above is 10^{-20}; hence the mass of an electron is $m = .65 \times 10^{-27}$ grams.

The number of electrons carrying one electro-magnetic unit of electricity is 10^{20}; consequently the mass associated with one unit of negative electricity is $.65 \times 10^{-7}$ grams. Gravitating matter as we know it is neutral as regards charge. There must be present then an equal amount of positive electricity. The mass associated with this positive electricity will also be $.65 \times 10^{-7}$ grams; hence the total mass that is associated in the combination of one unit each of both electricities is 1.3×10^{-7} grams.

This is the new unit of mass. The new gravitational constant may be found by substituting in the equation

$$F = k\frac{M,\ M^1}{r^2}.$$

The value of k for gram unit of mass is $6{,}673 \times 10^{-11}$, from which

$$F = \frac{1}{9 \times 10^{20} r^2} = \frac{1}{(3 \times 10^{10})^2 r^2} = \frac{1}{h^2 r^2}.$$

The symbol h is used because, although it is numerically equal to the ratio of the electrical units, it has not the dimensions of velocity.

The new gravitational equation may be written

$$F = C\frac{M, M^1}{r^2}.$$

The numerical value of C is the reciprocal of the square of the velocity of light.

Putting

$$h = \frac{1}{\sqrt{C}}$$

we may compare it with the well-known relation

$$v = \frac{1}{\sqrt{\mu K}}.$$

On the electromagnetic system $\mu = 1$, so

$$v = \frac{1}{\sqrt{K}},$$

the above equation may be written

$$F = K\frac{M, M^1}{r^2},$$

where K has the numerical value of the dielectric constant of the ether, but it is not a quantity of the same kind.

This rather remarkable relation between the gravitational constant and the constant of the ether is very suggestive. The only ratio e/m that will give this result is the one above used. It is also the most probable experimental value.

It appears to me that this coincidence can hardly be accidental.

If mass is electromagnetic, then the unit of mass here used is the rational unit, and the constant of mass attraction might be expected to be related to the constants of the ether.

The above result not only suggests that matter is electrical in constitution, but that gravitational force is the same in kind if not in degree with electrical forces, and that they act in a common medium.

It may be interesting to point out the relative magnitudes of electrical and gravitational forces.

The gravitational force is

$$F = k\frac{M, M^1}{r^2},$$

and the electrical force between the electricities contained in the masses M, M^1 if they were set free is

$$f = \frac{1}{K}\frac{Q, Q^1}{r^2}.$$

From which the ratio of electrical to gravitational force is

$$\frac{1}{Kk} = (3 \times 10^{10})^4.$$

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May 28, 1904.

THE ROYAL COMMISSION ON TUBERCULOSIS.

THE commission consisting of Sir Michael Foster, M.P. (chairman), Professor G. S. Woodhead, Professor Sidney Martin, Professor McFadyean and Professor R. W. Boyce has presented an *ad interim* report. It says:

"After duly considering the matter, we came to the conclusion that it would be desirable not to begin the inquiry by taking evidence—that is to say, by collecting the opinions of others (though this might be desirable at a later stage), but to attack the problem laid before us by conducting experimental investigations of our own.

"The first line of inquiry upon which we entered may be stated as follows: What are the effects produced by introducing into the body of the bovine animal (calf, heifer, cow), either through the alimentary canal as food, or directly into the tissues by subcutaneous or other injection, tuberculous material of human origin, *i. e.*, material containing living tubercle bacilli obtained from various cases of tuberculous disease in human beings, and how far do these effects resemble or differ from the effects produced by introducing into the bovine animal, under conditions as similar as possible, tuberculous material of bovine origin, *i. e.*, material containing living tubercle bacilli obtained from cases of tuberculous disease in the cow, calf or ox?

"We have up to the present made use in the above inquiry of more than twenty different 'strains' of tuberculous material of human origin—that is to say, of material